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Pricing for Southwestern Bell's ATM services is presented in Table 53.

Table 53
Southwestern Bell's ATM Service Pricing (\$)

	DS3	OC-3
Installation	600	565
Per month	2,700-3,000	3,200-3,600
First PVC	35	35
Additional PVC	25	25
Outside service areas	600 plus 200 per mile	700 plus 240 per mile
Constant bit rate	25 per megabit per month	25 per megabit per month
Variable bit rate	20 per megabit per month	20 per megabit per month

Source: Southwestern Bell, 1997

U S West INTERPRISE

U S West provides X.25, frame relay, and ATM services through its data networking arm, INTERPRISE. The provider offered SMDS until April 1996, migrating the few remaining SMDS customers to ATM.

In July 1996, INTERPRISE announced plans to enter 34 markets outside its 14-state region. By yearend 1997, the carrier intends to offer data services in 300 cities nationwide.

To enhance both its frame relay and ATM offerings, INTERPRISE announced its INTERVISTA Video Solutions Portfolio in October 1996. INTERVISTA applications are video over frame relay, video over internetworked frame-relay-to-ATM networks, video bridging, and managed video services.

X.25

U S West has integrated X.25 services into its ISDN traffic. Much of the growth of these services is from network expansion for applications such as Internet access and lottery applications. U S West's X.25 network is based on Nortel's Magellan DPN 100 platform.

Ninety-nine percent of U S West's X.25 traffic interconnects with another carrier's X.25 network.

Frame Relay

INTERPRISE's frame relay service growth comes predominantly from private line migration. At yearend 1996, the carrier reported an installed base of nearly 39,000 ports. Corporations and government accounted for most of the carrier's customer base.

The carrier's frame relay service supports multicast frame relay. Approximately 10% of INTERPRISE's frame relay ports interconnect with private line networks, and 5% interconnect with ATM networks. INTERPRISE uses Cascade 9000 frame relay switches and Motorola FRADs. The carrier also offers a bundled equipment/service package to support voice over frame relay and has signed up more than 100 customers.

The majority of INTERPRISE's connections are at 56Kbps, but the carrier believes that high-speed frame relay will contribute to the overall growth of the service. The carrier introduced DS3 and fractional T1 frame relay in December 1996 — initially in the out-of-region markets of Richmond, Virginia; Jacksonville, Florida; and Vermont — with strategic partner Hyperion Telecommunications. In March 1997, INTERPRISE West announced that it would roll out DS3 frame relay service in Colorado, Arizona, Minnesota, Utah, Washington, Idaho, and Oregon. In March 1997, the carrier also announced the availability of its dial-access frame relay offering in Denver, Colorado; Phoenix, Arizona; Minneapolis, Minnesota; Seattle, Washington; and six additional cities. The service offers remote dial-up access, disaster recovery, and managed POPs.

INTERPRISE now offers long distance frame relay capability in its out-of-region markets. In February 1997, the carrier announced the availability of inter-LATA frame relay services for businesses in 34 states. In certain expansion markets, the carrier will offer packaged local and long distance frame relay services.

INTERPRISE introduced Managed Data Services (MDS), an outsourcing solution, in May 1997.

INTERPRISE introduced Managed Data Services (MDS), an outsourcing solution, in May 1997. The service, available both in and out of region, currently supports frame relay and features flat-rate pricing based on the number of devices and ports in the data network. MDS supports Cisco, Bay Networks, and 3Com routers. Management for ATM and SNA networks and customer intranets will be available later in 1997.

ATM

INTERPRISE's ATM Cell Relay Service is available at T3 and OC-3 access speed; ATM T1 service will be introduced during the third quarter of 1997. Service growth is attributable to additional connections for existing customers, migration from other data services, and new customers.

In December 1996, INTERPRISE began the national rollout of managed ATM service in Richmond, Virginia; Jacksonville, Florida; and Vermont. Other services in the national expansion portfolio include fully managed DS3 and fractional T1 frame relay services.

The carrier's ATM service is offered on a Newbridge 36170 platform. In June 1997, INTERPRISE announced a multimillion-dollar reseller agreement with Cisco for WAN solutions. Under terms of the agreement, INTERPRISE is certified to sell and support Cisco's ATM switches.

GTE

GTE's data service portfolio includes X.25, frame relay, ATM, and SMDS.

X.25

GTE's X.25 service, Local Packet Switching Network Service, is based on Nortel's DPN-100 platform. Most connections are low speed (9.6Kbps), with 95% of connections used for terminal-to-host applications. GTE forecasts 10% growth through the end of 1997, fueled by remote access, sales to online service providers, and credit card authorizations.

Frame Relay

GTE's frame relay offering, based primarily on Cascade switches, provides access from speeds of 56Kbps to fractional T3. All connections are dedicated, and the service supports multicast frame relay. Corporations, education, and government each account for 30% of GTE's frame relay customer base, with other network service providers accounting for 10%.

GTE has NNI agreements with Intermedia, Southwestern Bell, Pacific Bell, Bell Atlantic, and Sprint. GTE does not offer frame relay service-level guarantees, nor does it provide customer network management services. GTE's frame relay services are targeted at applications such as terminal-to-host connections, imaging, e-mail, and graphic file transfers.

ATM

GTE offers transparent LAN service through its Virtual CO offering, a bundled, managed service in which an adaptation device is included in the monthly charge.

Live traffic on GTE's ATM network is currently in effect in the Los Angeles metropolitan area (Thousand Oaks and Santa Monica); Dallas/Fort Worth, Texas; Tampa, Florida; Erie and York, Pennsylvania; Honolulu, Hawaii; Botheu, Washington; Research Triangle Park, North Carolina; Bloomington, Illinois; Lexington, Kentucky; Manassas, Virginia; and Fort Wayne, Indiana. The primary driver of ATM growth is migration from other data services, followed by new subscribers and the addition of new connections.

GTE offers ATM service at DS1, T3, and OC-3 (OC-12 service is planned by yearend 1997). CBR, VBT-NRT, and UBR quality of service levels is available. GTE offers transparent LAN service through its Virtual CO offering, a bundled, managed service in which an adaptation device is included in the monthly charge. GTE has service interconnection agreements with BellSouth and Sprint in North Carolina, with Southwestern Bell in Texas, and with Pacific Bell in California.

GTE plans to roll out inter-LATA ATM service through GTE Long Distance during 1997.

GTE plans to roll out inter-LATA ATM service through GTE Long Distance during 1997. Other plans for 1997 include general availability frame-relay-to-ATM service internetworking, closed user group SVCs, Internet access, and ABR and VBR-RT classes of service.

GTE ATM customers include the U.S. Army, the Pinellas County Sheriff office in Florida, UCLA, and the state of North Carolina. The network is based on the Newbridge 36150 MainStreet platform.

SMDS

GTE's MegaConnect SMDS offers access from 56Kbps to fractional T3 speeds. MegaConnect is suitable for LAN-to-LAN connectivity, integrating networks such as ethernet, token ring, and FDDI. Most of GTE's SMDS customer base consists of education and government users, with a few entertainment industry customers in California. The provider's SMDS is based on an ADC Kentrox platform.

Interexchange Carriers

AT&T

In November 1996, AT&T announced a reorganization of its data network services. To better meet customers' needs, AT&T is focusing its solutions in four key areas: managed networks, remote access, data network services, and the Internet. As part of this announcement, the carrier also renamed several of its products to reflect the service name rather than the a specific services group. The new service names are illustrated in Table 54.

Table 54
AT&T's Data Network Services by Old and New Names

New Name	Old Name
AT&T X.25 Service	AT&T ACCUNET Packet Service
AT&T Frame Relay Service	AT&T InterSpan Frame Relay Service
	AT&T Local Frame Relay Service
AT&T ATM Service	AT&T InterSpan ATM

Source: AT&T, 1996

X.25

AT&T entered into an agreement with Infonet in June 1995, offering Infonet's dedicated and dial-up X.25 service to U.S.-based AT&T customers with global data networking needs.

However, AT&T no longer actively markets its X.25 Packet Service, and most of its X.25 customers are migrating rapidly to IP. Yet, AT&T still supports its X.25 customer base and is experiencing some X.25 traffic growth from existing customers. Most of AT&T's X.25 connections are dedicated, with 65% of customers connecting at 56/64Kbps and the remaining 35% at 9.2Kbps. The service is provided on a Lucent Technologies platform.

Frame Relay

AT&T upgraded its nationwide frame relay network during 1996, replacing the StrataCom IPX switches with Stratagem's BPX and AXIS switches based on a T3 architecture. AT&T's frame relay service offers access at maximum speeds of T3. Analog and ISDN dial-up capabilities and frame-relay-to-ATM internetworking are also available.

In January 1997, AT&T announced that it would integrate ADC Kentrox's PACESETTER Pro access router into its ISDN and frame relay services. This flexible router can act as either a host on the remote LAN or a classic router.

In November 1996, AT&T unveiled two new frame relay offerings:

- AT&T Frame Relay Central Office FRAD for customers with low-speed SNA data applications and who do not want to make CPE investments.
- AT&T Managed FRAD Solution for SNA customers with limited LAN interconnect requirements. The service consolidates legacy protocols onto a single network. AT&T supplies and manages the FRADs (initially from Motorola) and DCE.

In February 1997, AT&T announced the creation of Managed Network Solutions (MNS), a new set of offerings combining AT&T's network management capabilities.

AT&T's existing Managed Router Solution offers a full range of options for global WAN management and uses routers from Cisco, Bay Networks, and 3Com. In February 1997, AT&T announced the creation of Managed Network Solutions (MNS), a new set of offerings combining AT&T's network management capabilities. With MNS, customers can select complete outsourcing or piecemeal management. Specific offerings scheduled to be rolled out in 1997 include SNA and ATM management.

AT&T's frame relay service interconnects with X.25 (AT&T and Infonet), WorldPartners members' frame relay networks, private lines, and ATM (service internetworking). In March 1997, AT&T raised its frame relay prices of ports and PVCs by about 5%. Table 55 presents AT&T's domestic frame relay pricing.

AT&T provides its customers with disaster-recovery options, including the Access Protection Option and two Site Recovery Options. The Access Protection Option protects against circuit and CPE failures by enabling customers to redirect PVCs to an alternate access channel. Site Recovery Options protect against site failures by allowing customers to reconfigure their networks and redirect data to an alternate site.

The company complements these services by providing a network interface for customers to manage their networks. AT&T provides SNMP access to statistical information such as information about PVCs, ports, and lines.

Table 55
AT&T's Domestic Frame Relay Pricing

PVC CIR (Kbps)	Monthly Two-Way PVC Charge (\$)	Port Speed (Kbps)	Monthly Port Charge (\$)
56/64	99	56/64	270
128	225	128	545
192	338	192	670
256	450	256	810
320	563	320	945
384	675	384	1,090
448	854	448	1,215
512	964	512	1,340
576	1,153	576	1,405
640	1,229	640	1,480
704	1,362	704	1,555
768	1,575	768	1,625
832	1,723	1,024	1,910
896	1,872	1,544	2,415
960	2,025		
1,024	2,175		

Source: AT&T, April 1997

WorldPartners/AT&T-Unisource Frame Relay Service

WorldPartners' WorldSource Frame Relay Service is available in 30 countries outside the United States: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Indonesia, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Malaysia, the Netherlands, New Zealand, Norway, the Philippines, Portugal, Singapore, Spain, Sweden, Switzerland, Taiwan, Thailand, and the United Kingdom.

In July 1997, WorldPartners announced that TELEBRAS (Brazil) would begin offering WorldSource Frame Relay service in the fourth quarter of 1997. In May 1997, SPT Telecom (Czech Republic) and AT&T-Unisource announced the interconnection of their frame relay services. AT&T and Telinatar (Argentina) announced the availability of frame relay service between the United States and Argentina in September 1996. Services were rolled out to support AT&T customers such as 3M, Honeywell, and J.P. Morgan.

WorldPartners' WorldSource frame relay service is based on a StrataCom IPX/BPX backbone. Frame relay switches are interconnected over the WorldPartners Private Line Backbone and support port speeds from 56Kbps to T1/E1. AT&T also offers global access to its frame relay service through Infonet's global X.25 network.

In December 1996, the provider signed an agreement with Hoechst for global services. The contract, valued at \$50 million annually, is for frame relay and router management services in Western Europe. AT&T-Unisource Communications Services will provide the data transport capabilities, and AT&T Global Network Management Center will provide service management.

ATM

AT&T's ATM service is available at T1, T3, and OC-3 access speeds. Managed ATM service, offered under the carrier's Managed Network Services, is scheduled for general availability during 1997.

In February 1997, AT&T introduced the industry's first ATM SVCs.

In February 1997, AT&T introduced the industry's first ATM SVCs. AT&T's ATM SVC service is available at T1 and T3 port speeds and offers transmission at maximum speeds of 10Mbps. The service classes supported are CBR, VBR-NRT, and UBR. Service pricing is based on class of service, call duration, and the connection speed associated with each call. ATM SVC rates at selected transmission speeds are presented in Table 56.

Table 56
AT&T's ATM SVC Pricing by Connection Speed

Connection Speed	CBR per-Minute Rate (\$)	VBR per-Minute Rate (\$)
4Kbps	0.012	0.006
56/64Kbps	0.06	0.035
256Kbps	0.29	0.16
384Kbps	0.43	0.24
512Kbps	0.64	0.37
768Kbps	0.99	0.58
1.536Mbps	1.44	NA
3.1Mbps	2.88	1.69
6.2Mbps	8.80	NA
8.2Mbps	14.66	8.63
10.8Mbps	20.70	NA

Source: AT&T, 1997

AT&T's ATM SVC Unspecified Bit Rate two-way service is priced at \$0.035 per minute. UBR call pricing is based on call duration and traffic volume.

AT&T is the first IXC to publish its ATM list prices. Pricing is based on ports and PVCs. AT&T increased port prices in March 1997. The monthly (nondiscounted) charge for a DS1 port is \$2,415 (a 5% increase) and \$12,650 for a DS3 port (a 15% increase). Table 57 presents selected pricing by CIR for AT&T's ATM PVCs.

Table 57
AT&T's ATM PVC Pricing

ATM PVC CIR	Class A Monthly Charge (\$)	Class C Monthly Charge (\$)
56/64Kbps	173	99
256 Kbps	780	450
384Kbps	1,166	675
512Kbps	1,748	1,012
768Kbps	2,717	1,575
1.536Mbps	4,313	2,415
3.1Mbps	5,865	3,450
6.1Mbps	10,557	6,210
8.2Mbps	14,076	8,280
10.2Mbps	17,595	10,350
10.8Mbps	18,630	NA
15.4Mbps	NA	15,525

Source: AT&T, 1997

AT&T's ATM service is deployed on a MultiFinder platform that includes Lucent Technologies' Globeview 2000 Broadband System. In January 1997, the provider announced compatibility testing of CrossComm's XLT-F Edge Router and AES ATM Edge Switch products to support AT&T's ATM services.

International ATM Service

In May 1997, AT&T announced its first global ATM rollout with Kokusai Denshin Denwa (KDD) in Japan. The findings of four AT&T-KDD ATM trials conducted during 1996 are being incorporated into ATM service development. AT&T plans to roll out service to Canada in September 1997 through AT&T Long Distance Canada. By yearend 1997, service rollouts are expected in the United Kingdom through an AT&T subsidiary and in the rest of Europe through AT&T-Unisource. AT&T will offer both CBR and VBR classes of ATM service, but it does not plan to offer service-level guarantees.

Cable & Wireless

The Cable & Wireless Business Networks (CWBN) Global Managed Data Service portfolio includes X.25 and frame relay services.

X.25

Cable & Wireless's X.25 CONNECT service supports network applications at maximum speeds of 56Kbps and offers high-speed X.25 service for LAN interconnection at 128, 192, and 256Kbps. Data Connect, another X.25 application, provides access to online

information databases. X.25 CONNECT is accessible from more than 80 countries.

Cable & Wireless's X.25 service is a fully managed service, and the carrier leases and manages most customer premises equipment on an ongoing basis. The majority of connections are for terminal-to-host applications, but a significant percentage is used for Internet access applications. Other applications driving demand include financial/point-of-sale transactions, remote access, and customer order processing.

The carrier's service operates on a Nortel DPN-100 platform.

Frame Relay

Cable & Wireless LAN Connect, the carrier's frame relay service, includes end-to-end network management, digital local access, optional CPE, and proactive network monitoring down to the customer premises. Cable & Wireless provides access at speeds between 56Kbps and T1. The frame relay network is based on Nortel's DPN-100 platform.

In July 1997, Cable & Wireless announced the availability of a fully managed Nx56/64Kbps ISDN dial-backup service, with speeds up to 512Kbps.

Dial backup is integrated when ISDN or Switched 56 facilities are available. In July 1997, Cable & Wireless announced the availability of a fully managed Nx56/64Kbps ISDN dial-backup service, with speeds up to 512Kbps. Pricing for the carrier's frame relay services is presented in Table 58.

Table 58
Cable & Wireless's Frame Relay Pricing by Port Speed

Port Speed (Kbps)	Installation (\$)	Monthly Recurring Charge (\$)	Duplex PVC (Kbps)	Monthly Recurring Charge (\$)	Simplex PVC (Kbps)	Monthly Recurring Charge (\$)
56	300	195	19.2	90	19.2	45
128	300	330	38.4	210	38.4	105
256	300	390	56/64	300	56/64	150
384	300	570	128	400	128	200
512	300	730	256	800	256	400
768	300	940	384	1,200	384	600
1,024	300	1,170	512	1,550	512	775
1,536	300	1,560	768	2,400	768	1,200
			1,024	3,000	1,024	1,500

Note: Prices do not include local loop or DSU/CSU charges.

Source: Cable & Wireless, 1997

C&W's frame relay services support LAN-to-LAN applications, as well as SNA and LAN-to-SNA connections. The carrier offers Managed Router Service for frame relay networks. C&W offers a service-level agreement for network availability and performance

targets for quality-of-service commitments such as data delivery rate, transit delay, and mean time to repair.

International Frame Relay

C&W offers frame relay service in 27 countries, including most of Western Europe, Japan, Australia, Hong Kong, the Philippines, Taiwan, and India.

ATM

In June 1997, C&W announced the launch of its Global ATM service, the first phase of which will link the United States and the United Kingdom. C&W will follow up with service rollouts across Europe and in Asia.

The service is available at access speeds of T1 to T3 in 1Mbps increments. The service is provided on a Nortel platform.

LCI International

Frame Relay

The company's frame relay service is based on a Newbridge MainStreet platform. LCI's FramePlus service features three offerings:

- Simply Guaranteed for customers billing \$200–25,000 per month
- Integrity for customers billing \$25,000–150,000 per month
- Choice VNS for customers billing more than \$150,000 per month

In July 1997, LCI announced the availability of Web-based reporting for FramePlus.

The service supports access speeds ranging from 56Kbps to T1 and is available from more than 460 POPs in the United States and 50 other countries. The carrier also offers multicast support. In March 1997, LCI introduced a money-back guarantee for quality of service related to network transit delay. LCI also introduced network availability and throughput guarantees. In July 1997, LCI announced the availability of Web-based reporting for FramePlus. Report topics include PVC throughput summary, port availability, CIR utilization per PVC, transmission error, physical port utilization, congestion notification, and network configuration.

LCI's frame relay growth continues to come from new customers. LCI is also migrating many of its own private line customers to the frame relay, though SNA customers have been much slower to adopt frame relay because of lack of support for their applications. The new quality-of-service guarantees are partially aimed at wooing reluctant SNA users.

In early 1996, LCI rolled out its Authority Network Management System, an online customer network management tool that allows customers to change their CIRs on demand and on site.

LDDS WorldCom and MFS

X.25

In August 1995, LDDS WorldCom created a limited-liability corporation called GridNet International. The company rolled out services in June 1996 with Juno Online Services as its first customer. GridNet International, based in Atlanta, offers 950, 800, or local access services layered over LDDS WorldCom's digital network. Services include X.25 transaction services, X.25 high-speed online services, and IP dial or SLIP/PPP services.

LDDS WorldCom has a small number of dedicated X.25 connections, the majority of which are installed at 56/64Kbps. The service is provided on an Alcatel equipment platform.

Frame Relay

In the past, all of LDDS WorldCom's frame relay traffic originated in the United States and terminated either within the United States or internationally. Frame relay traffic origination outside the United States began in late 1996. The service is provided over a StrataCom IPX/Cascade 9000 backbone. MFS's local frame relay networks also use Cascade 9000 switches.

In early 1997, LDDS WorldCom introduced NxDS1 frame relay service, using Larscom's broadband inverse multiplexers.

LDDS WorldCom's frame relay service supports access speeds ranging from 56Kbps to fractional T3 (6Mbps, 10Mbps, and 19.8Mbps). In early 1997, LDDS WorldCom introduced NxDS1 frame relay service, using Larscom's broadband inverse multiplexers. LDDS WorldCom also supports frame-relay-to-ATM internetworking and offers dial-up frame relay access. WorldCom does not support frame relay multicasting, although MFS's local networks have this capability, given the predominance of LAN-to-LAN traffic.

LDDS WorldCom has NNI agreements with carriers in more than 40 LATAs and U.S. cities. Selected NNI agreements are presented in Table 59.

Table 59
Selected LDDS WorldCom NNI LEC Agreements by LATA

LATA	LEC
Denver, Seattle, Phoenix, and Minneapolis	U S West
Pittsburgh; Philadelphia; Washington, D.C.; Newark; and Baltimore	Bell Atlantic
Atlanta and Miami	BellSouth
Chicago	Ameritech
Los Angeles and San Francisco	Pacific Bell
Tampa	GTE
New York and Boston	Nynex
Hartford	Southern New England Telephone
Kansas City, St. Louis, Dallas, and Houston	Southwestern Bell

Source: LDDS WorldCom, 1997

The carrier's frame relay growth is being driven by the migration of private line customers. In general, the company has also found that SNA is becoming an important application, followed closely by voice over frame relay.

International Frame Relay

Through WorldCom International, the carrier provides frame relay connectivity to more than 35 countries and 80 cities worldwide through MFS's facilities and via NNI agreements. Recent NNI agreements include Embratel (Brazil), Shanghai Post and Telecommunications (China), TeleMedia International (Telecom Italia), and Telefonos de Mexico (TELMEX). With the acquisition of MFS, WorldCom acquired networks in Frankfurt, Paris, Stockholm, London, Zurich, Hong Kong, and Mexico City.

ATM

Typical LDDS WorldCom corporate customers are companies in the supercomputing and software industries. ISPs also represent a significant percentage of the company's ATM business. The primary driver of LDDS WorldCom's ATM growth is new subscribers, followed by additional connections for existing customers, migration from other data services, and the carrier's frame-relay-to-ATM-service internetworking offering. The equipment platform consists of StrataCom BPX and Cascade 500 switches.

LDDS WorldCom expects to launch ATM SVCs during 1997 and is also planning an ATM T1 service.

LDDS WorldCom expects to launch ATM SVCs during 1997 and is also planning an ATM T1 service. The carrier currently offers CBR, VBR-NRT, and ABR service and plans to roll out UBR service by yearend 1997. The company's ATM pricing is on an individual-case basis. On the local level, MFS offers service at access speeds of T3 and OC-3.

In early 1997, LDDS WorldCom announced plans to purchase 27 Cascade CBX 500 ATM switches to expand and build a 622Mbps ATM backbone network for its ATM and frame relay services.

Internationally, WorldCom began testing a direct frame relay service between China and Taiwan in association with Chunghwa Telecom in late 1996.

MCI

MCI's data service portfolio includes X.25 services, named XStream, and frame relay, ATM and SMDS services, under the HyperStream family of services.

In January 1997, the company announced a new strategic direction. MCI's Internet 2000 initiative is a project for the development of a new network architecture code, called VAULT. This infrastructure bridges and integrates traditional telephone networks with packet-switched IP and frame relay networks. VAULT is expected to be a fully integrated and seamless communications platform that will eliminate the hassles associated with translating traffic across disparate networks. MCI is targeting this technology at applications

such as communications management, collaborative multimedia applications, fax applications, and intranet managed services.

X.25

MCI acquired an X.25 business when it purchased BT NA from British Telecom in 1994. MCI's X.25 network is a proprietary network based on Tymnet Technology's equipment.

Frame Relay

MCI is positioning high-speed frame relay as an intermediate step toward ATM migration.

Access to MCI's HyperStream frame relay service is available at port speeds of 16Kbps to 12.288Mbps. High-speed frame relay access, introduced in December 1996, enables customers to inverse-multiplex up to eight T1 lines to achieve frame relay port speeds of 3.072Mbps to 12.228Mbps. MCI is positioning high-speed frame relay as an intermediate step toward ATM migration. In early 1997, MCI rolled out a standard frame-relay-to-ATM offering.

MCI's domestic frame relay platform is based on Bay Networks' Broadband Network Access (BNX) switch, supported by Backbone Concentrator Node (BCN) hardware.

MCI does not support multicast frame relay, because this feature is available through its SMDS offering. Approximately 95% of MCI's frame relay connections are dedicated.

In mid-1996, MCI restructured its frame relay pricing. Recognizing customers' need to build out their networks with additional PVCs, MCI lowered the price of PVCs and increased port prices. This strategy served to simplify service pricing, and customers realized the benefits associated with usage-based CIRs. In early 1997, MCI lowered the price of certain higher-speed PVCs and raised port prices. Under a new May 1997 tariff, port prices rose again, but MCI lowered the minimum usage charge for all usage-based PVC CIRs to \$5 per month. Lower PVC pricing was designed to encourage the use of additional PVCs (for increased connectivity or backup) and to promote the implementation of mesh topologies. Tables 60 and 61 present MCI's most recent port and fixed-rate PVC prices.

In January 1997, MCI introduced Priority PVC service for SNA traffic, a product that allows customers to prioritize their data traffic.

In January 1997, MCI introduced Priority PVC service for SNA traffic, a product that allows customers to prioritize their data traffic. Using the guidelines provided by CIR and Discard Eligible cells, Priority PVC enables customers to tailor their PVCs as high, low, or medium priority to expedite time- and mission-critical applications and traffic.

Table 60
MCI Frame Relay Port Pricing by Speed

Port Speed (Kbps)	Monthly Recurring Charge (\$)
56/64	228
112/128	415
224/256	560
336/384	810
448/512	950
672/768	1,270
896/1,024	1,590
1,344/1,536	1,980
2,688/3,072	2,449
4,032/4,608	2,989
5,376/6,144	3,529
6,720/7,680	4,069
8,064/9,216	4,609
9,408/10,752	5,149
10,752/12,288	5,689

Source: MCI, 1997

Table 61
MCI's Frame Relay Fixed-Rate PVC Pricing

CIR (Kbps)	Monthly Recurring Charge (\$)	CIR (Kbps)	Monthly Recurring Charge (\$)
16	16	672/768	735
32	31	728/832	840
48	42	840/960	945
56/64	47	896/1,024	1,050
112/128	105	1,008/1,152	1,188
168/192	168	1,120/1,280	1,296
224/256	210	1,232/1,408	1,404
280/320	262	1,344/1,536	1,512
336/384	336	3,072	1,674
392/448	420	4,608	1,836
448/512	472	6,144	1,944
504/576	552	7,608	2,052
560/640	630	9,216	2,160
616/704	682	10,752	2,268

Note: A \$15 per-PVC nonrecurring installation, deinstallation, and reconfiguration charge applies.

Source: MCI, 1997

MCI announced its first Bell Company frame relay NNI agreement with BellSouth in July 1996. NNI agreements have also been concluded with Bell Atlantic, Pacific Bell, Southwestern Bell, U S West, GTE, and Ameritech.

MCI provides service-level guarantees for its frame relay service, encompassing latency, packet delivery, network availability, mean time to repair, and network transit delay. Each agreement is backed by customer credits if MCI fails to meet any of these objectives.

In December 1996, MCI approved Sync Research's FrameNode family of SNA internetworking FRADs. With managed SNA FRAD service, customers can lease or purchase Sync products through MCI.

International Frame Relay

MCI's international frame relay network is based on a StrataCom platform. Concert Frame Relay Service is available in Israel and 34 other countries in North and South America, Europe, Asia, and South Africa. Concert offers managed frame relay service on an individual-case basis.

ATM

During 1997, MCI added new types of ATM service customers, including ISPs and companies in the entertainment and health care industries.

MCI's HyperStream ATM service is available at access speeds of DS1, fractional T3, DS3, and OC-3. MCI's ATM network is based on Nortel Vector and GDC Apex NPX platforms. In May 1997, MCI announced the availability of lower-speed ATM access options in NxT1 increments through 12Mbps. The HyperStream inverse-multiplexing service uses the 3Com Access Builder 9600 multiservice access platform.

Most of MCI's HyperStream ATM service revenue is generated within the United States. MCI provides VBR-RT, VBR-NRT, CBR, and UBR services (the latter is provided on an individual-case basis). New subscribers continue to be the primary growth engine for MCI's ATM services, followed by new connections for additional subscribers and migration from other data services. During 1997, MCI added new types of ATM services customers, including ISPs and companies in the entertainment and health care industries.

MCI plans to introduce ATM SVC services in late 1997 or early 1998. Plans are also under way to roll out ATM OC-12 by yearend 1997.

MCI's ATM traffic is predominantly data (60%), whereas voice and video account for 20% each of total ATM traffic. MCI charges for ATM services based on port speed, service class, and sustainable cell rate (SCR). The SCR is the upper boundary, or burst allotted, above the average rate of connection. MCI plans to introduce ATM SVC services in late 1997 or early 1998. Plans are also under way to roll out ATM OC-12 by yearend 1997.

International ATM

In March 1997, MCI announced the commercial availability of HyperStream ATM service to the United Kingdom, linking MCI's service with BT's CellStream ATM service. Through Concert Communications Services, MCI and BT will develop a fully managed global ATM service, scheduled for delivery in 1998. Concert is currently deploying ATM switches in 13 countries, including

France, Germany, Sweden, Australia, and Japan. MCI announced the commercial availability of ATM services between the United States and Canada (Bell Canada) in August 1997.

SMDS

MCI provides its HyperStream SMDS from about 500 POPs in the United States. In May 1997, MCI announced the first service-level guarantee for SMDS in the United States, covering mean time to repair, network availability, one-way packet delay, and packet delivery.

The United States accounts for 90% of MCI's SMDS service revenue, with 10% of revenue realized from Western Europe. Corporations represent 85% of MCI's SMDS customer base. Government and education customers represent 10% and 5% of the total, respectively.

HyperStream SMDS supports multicasting, group addressing, and closed user groups. Data accounts for 85% of MCI's SMDS traffic, with voice traffic accounting for the remaining 15%. SMDS pricing is customer specific, based on the type of service, access speed, and amount of traffic delivered (usage per megabyte).

MCI's network is based on Siemens and Cascade equipment. MCI has established NNI agreements with Ameritech, GTE, Pacific Bell, BellSouth, and Bell Atlantic. The carrier plans to roll out standardized SMDS-to-ATM service internetworking during 1997.

Sprint

Sprint offers X.25, frame relay, and ATM services.

X.25

Approximately 70% of Sprint's X.25 ports are dial-up ports, the majority of which are used by America Online, Sprint's single largest X.25 customer.

Sprint's X.25 service accounts for approximately two-thirds of total X.25 market revenue. Approximately 70% of Sprint's X.25 ports are dial-up ports, the majority of which are used by America Online, Sprint's single largest X.25 customer.

Sprint's X.25 services are provided over an Alcatel Data Networks TPX platform. Sales to online service providers and ISPs account for 50% of Sprint's total X.25 sales. Sprint (and other carriers) see PPP over X.25 at 28.8Kbps as a new market opportunity for X.25. Applications that continue to drive demand for Sprint's X.25 services include fail-safe routing and banking applications, particularly residential banking. Sprint's X.25 also has a stronghold in vertical markets that have not yet fully implemented IP services.

International X.25

Sprint provides X.25 service outside the United States through Global One. Sprint receives revenue from Global One international X.25 service sold to Sprint's U.S. customers.

Frame Relay

In July 1997, Sprint introduced applications-based service classes for frame relay.

In July 1997, Sprint introduced applications-based service classes for frame relay. The enhanced service-level agreements for LAN, SNA, and voice over frame relay (the latter scheduled for early 1998) guarantee specific levels of throughput, response time, and network availability. The new SLAs also include PVC prioritization for SNA traffic. The new service-level agreements also include end-to-end latency guarantees covering Sprint's network as well as local service providers' access and termination circuits.

A significant portion of Sprint's frame relay service growth comes from the expansion of existing customers' networks. Other growth is being driven by non-Sprint customers' migration from private line and X.25 to frame relay. The ISPs are emerging as a small but growing market, and Sprint plans to target this sector more aggressively. Finally, growth in the LAN-to-SNA area is also a significant market driver for Sprint. Sprint's differentiator is the historically broad availability and high performance of its service. Sprint's frame relay port pricing is presented in Table 62.

Table 62
Sprint Frame Relay Port Pricing by Speed

Port Speed (Kbps)	Monthly Recurring Charge (\$)
56/64	204
112/128	355
168/192	430
224/256	495
336/384	705
392/448	775
448/512	860
504/576	940
560/640	990
672/768	1,070
784/896	1265
896/1,024	1,375
1,120/1,280	1,595
T1	1,800

Note: A \$250 nonrecurring installation charge applies for all port speeds.

Source: Sprint, 1997

Sprint's PVC, Burst Express, has a monthly recurring charge of \$100. Pricing for Burst Express Plus (with Committed Information Rate) is as follows:

- \$140 per month for 16Kbps CIR
- \$170 per month for 32Kbps CIR

Sprint's frame relay service is provided over Alcatel Data Networks' TPX 1100 platform. Sprint's frame relay service is available in 350 U.S. locations. Sprint will be upgrading its frame relay network backbone to DS3, given that companies are increasingly calling for frame relay access above T1.

Large and medium-sized businesses account for 95% of Sprint's frame relay customer base. Small business customers continue to use X.25 and IP services, particularly for terminal-to-host applications, but they are gradually migrating LAN-to-LAN and LAN-to-host applications over X.25 to frame relay.

Through NNI agreements, 20% of Sprint's frame relay ports interconnect with another provider's frame relay network. Five percent of Sprint's frame relay ports interconnect with Internet/IP networks, and Sprint expects this interconnection segment to increase significantly by yearend 1997.

A very small percentage of Sprint's frame relay connections are dial-up access and are primarily used for backup purposes. However, Sprint is working to develop the dial-up arena, particularly for remote access applications. Sprint is also developing a bundled package of services and CPE for voice over frame relay; these services are planned for introduction by yearend 1997.

Recent Sprint frame relay contracts include a three-year agreement announced in September 1996 between Sprint's Hospitality Group and Omni Hotels to provide frame relay and managed network services to 25 Omni Hotel properties.

Global One Frame Relay

Global One frame relay service is available from more than 800 sites in 29 countries outside the United States: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Ireland, Israel, Italy, Japan, Luxembourg, Mexico (announced May 1997), the Netherlands, New Zealand, Norway, Portugal, Romania, Russia, Singapore, Spain, Sweden, Switzerland, South Korea, United Arab Emirates (announced February 1997), the United Kingdom, and Venezuela (announced April 1997). During 1997, Global One plans to expand frame relay service availability to a total of 40 countries. Contractual service-level agreements are available on an individual-case basis.

ATM

Sprint's ATM growth is driven primarily by new customers, followed by additional connections for existing customers and migration from other data services.

All of Sprint's ATM service revenue is generated within the United States. Sprint offers VBR and CBR services, which account for 85% and 15% of Sprint's ATM service revenue, respectively. Sprint is offering UBR services to some customers, but this is not yet a general availability offering. Sprint's ATM growth is driven primarily by new customers, followed by additional connections for existing customers and migration from other data services. More than 60% of Sprint's ATM customers are corporations. Approximately 20% of the ATM customer base consists of Internet

service providers that transport their IP traffic over Sprint's ATM network.

Sprint's ATM traffic is predominately data (85%), with voice and video accounting for 10% and 5% of traffic, respectively. Integrated traffic (i.e., some combination of voice, data, and/or video) accounts for less than 25% of Sprint's total ATM traffic. The majority of Sprint's ATM customers access the network at speeds of T3 and OC-3, but Sprint also offers T1 ATM and 2xT1, 4xT1, 6xT1, and 8xT1. Sprint is optimistic about the growth of T1 ATM services, but it believes that further advancements of the CPE side will be needed to support scaled-down ATM services.

Sprint's ATM pricing plans include usage-sensitive options for low-to medium-volume locations and flat-rate options for higher-volume sites.

NEC ATOMNET/M20 switches form the core of Sprint's ATM network. The backbone also includes Nortel's Magellan Vector edge switch. In addition, Sprint uses Hitachi's 5001 access switch to support its T1 services. Sprint's ATM CPE suppliers include Cisco, Fore Systems, and ADC Kentrox. Sprint leases CPE to about 35% of its ATM customer base (including equipment installation and maintenance). The carrier leases and manages CPE on an ongoing basis (i.e., for a recurring monthly fee) for about 5% of its ATM customer base.

Sprint expects to implement an evolution toward ATM SVC service through 1998 as central office and customer premises equipment upgrades proceed.

Recent ATM contracts include five-year agreements with health care facilities Florida Hospital (Orlando) and St. Luke's-Shawnee Mission Health System (Kansas City) for telemedicine and integrated telecommunications services.

Value-Added Network Providers

CompuServe Network Services

CompuServe Network Services offers X.25 and frame relay services.

X.25

A significant portion of CompuServe's X.25 revenue is generated outside of the United States. Although 40% of CompuServe's X.25 service revenue originates in the United States, 20% originates in Western Europe, 10% in Asia/Pacific, 20% in Eastern Europe, and 10% in Latin America, giving the provider significant market coverage. CompuServe provides its X.25 services over a StrataCom platform.

CompuServe is seeing new growth for its X.25 services only in Europe.

CompuServe is seeing no new growth for its X.25 services except in Europe. The U.S. market is saturated, though the company expects that X.25 will continue to be used in the U.S. market for applications such as banking transactions and legacy traffic.

Frame Relay

CompuServe's FRAME-NET frame relay service supports access speeds from 56Kbps to T1. FRAME-NET is based on StrataCom IPX and BPX FastPacket networking systems.

CompuServe's frame relay growth is fueled primarily by new customers, particularly smaller companies using 56Kbps connections. SNA over frame relay is a popular application for CompuServe customers.

FRAME-NET service features fixed monthly charges based on link access speed and PVCs established for each site. CompuServe offers service-level guarantees on a case-by-case basis. Options include online performance data, real-time reporting, and graphical and text reporting of performance statistics. The carrier is implementing automated trouble-ticket reporting.

Infonet

Infonet offers X.25 and frame relay services on its World Network, which is accessible from more than 100 countries.

X.25

Infonet's X.25 service growth is being driven by financial transaction-oriented applications, remote access (particularly PPP over X.25), messaging, and database inquiries.

Traffic on Infonet's X.25 network is increasing, but the growth in the total number of connections has been relatively flat. Infonet's X.25 service growth is being driven by financial transaction-oriented applications, remote access (particularly PPP over X.25), messaging, and database inquiries. These applications tend to require low-speed dial-up connections and are provided from a Siemens EWSP platform.

Infonet is enhancing its dial-up network, offering security services such as user validation, secure ID, and billing supplements. These reports will enable a customer to see who is using the network and for how long, helping companies to better manage their networks.

Approximately 65% of Infonet's X.25 connections are dedicated. Half of the carrier's X.25 customers connect at 9.6Kbps, with 30% accessing the network at 56/64Kbps, and 20% at 19.2Kbps.

Corporations account for about 80% of Infonet's X.25 customer base, with wholesale to other Internet/online service providers accounting for the remaining 20%. Forty percent of the carrier's X.25 revenue originated from the United States. An additional 40% of revenue originated from Western Europe, followed by 12% from Asia/Pacific and 5% from Latin America.

Frame Relay

Infonet's INFOLAN On-Line Frame Relay service provides any-to-any connectivity, flexible configuration of PVCs, and access at speeds of 9.6Kbps to T1/E1. The service is available in more than 30 countries, with expansion into the following Latin America

countries announced in July 1997: Brazil, Mexico, Colombia, Venezuela, Colombia, Costa Rica, and Chile.

To date, frame relay growth has been almost exclusively the result of new customers, 10–20% of which migrate from other carriers' X.25 services. The bulk of Infonet's installed frame relay ports are 56/64Kbps, but the fractional T1 segment is growing. Infonet plans to offer ATM service within the next two years and is currently creating a frame-relay-to-ATM migration path.

In July 1996, Infonet launched Integrated Media Services (IMS), an offering that combines voice, data, and fax over frame relay, X.25, or TCP/IP networks.

Infonet's frame relay services are provided over a Nortel Passport platform. Infonet supports multicast frame relay on a special-request basis and offers a bundled package of equipment and services to support voice over frame relay. In July 1996, Infonet launched Integrated Media Services (IMS), an offering that combines voice, data, and fax over frame relay, X.25, or TCP/IP networks. The service is based on "priority frame" technology developed jointly by Nortel and Infonet. IMS is available in more than 30 countries. IMS activation requires a 56/64Kbps connection to Infonet's network.

Infonet has NNI agreements with a number of carriers, including Electric Lightwave (a U.S.-based reseller), Westinghouse (a U.S.-based reseller), WorldCom (resale agreement), AT&T, Unisource, Deutsche Telekom, Embratel (Chile), Acasia (a Southeast Asian carrier consortium and international reseller), and ACCESS A.S. Data Communications (Turkey).

Forty-five percent of Infonet's frame relay revenue originates from the United States and Western Europe. Nine percent of revenue originates from Asia/Pacific, with Japan, Singapore, and Australia being the most important regional markets.

The company provides service-level agreements for 99.9% network availability. Infonet provides managed support for routers, FRADs, and voice FRADs (the latter are employed by 5% of the customer base). Between 25% and 50% of Infonet's customers employ managed frame relay services, and Infonet reports that managed services are taking off significantly in Europe.

In January 1997, Infonet signed a contract with Liz Claiborne for frame relay services. Infonet helped to implement a network solution for communications between the company's Pacific Rim facilities and corporate headquarters. The goal of the network is to enable manufacturing offices to communicate about manufacturing requirements, needs, and status.

IBM Global Network

Frame Relay

In September 1996, IBM Global Network (IGN) announced an enhancement of its Managed Data Network Services (MDNS).

In September 1996, IBM Global Network (IGN) announced an enhancement of its Managed Data Network Services (MDNS). The redesigned network is based on a frame relay infrastructure, thereby enabling easy migration to ATM. General availability in the United States began in January 1997.

All of IGN's frame relay connections are dedicated access. Its frame relay customer base is evenly divided between medium-sized and large accounts. IGN sells and manages CPE to/for its entire customer base (routers and FRADs).

IGN offers managed access connections for frame relay at port speeds of 56Kbps to T1/E1. PVC CIRs range from 4Kbps to T1/E1. Supported protocols include SNA, TCP/IP, and IPX. NetBIOS support is also available on request. IGN's network is based on a Cascade 7000 platform. By September 1996, IBM had implemented its own frame relay network in 86 cities worldwide. As part of the revamped MDNS offering, T3 frame relay connections are available on a case-by-case basis.

In April 1997, IGN announced that the planned availability of additional MDNS features would be delayed. These features include service-level agreements with penalty clauses (e.g., availability, performance, and mean time to repair), backup options, and support for SNA network interconnect to frame relay.

In June 1997, IGN announced the availability of business recovery services for MDNS. Customers have the option of building connectivity to an IBM/Advantis Business Recovery Services Center into their networks. Service options include line speeds from 56Kbps to T1, as well as switched 56Kbps.

UniSPAN

UniSPAN is a consortium of five companies, the largest being Intermedia Communications.

Founded in 1994 to provide end-to-end frame relay services nationwide and internationally, UniSPAN is a consortium of five companies, the largest being Intermedia Communications. The other UniSPAN members are PacNet, NorLight (a subsidiary of MRC Telecommunications), Integrated Network Services (25% owned by Sprint Canada), and TeleMedia International. At present, UniSPAN has more than 150 frame relay switches installed worldwide.

Intermedia had 90 data switches installed and approximately 12,000 frame relay ports as of 1Q97. The network uses Cascade B-ISDX switches on a cell-based DS3 ATM backbone, allowing for easy migration when ATM services are available. The carrier plans to implement priority frame relay as an ATM application solution during 1997.

Intermedia's frame relay service supports Dedicated Digital Services, Network-to-Network interface with local exchange carriers, and ISDN and asynchronous dial-up access in certain markets. Dial-up access is available at 9.6Kbps, and dedicated access is available at maximum speeds of 20Mbps in certain areas.

The majority of Intermedia's frame relay revenue originates in the United States, with Latin America and Western Europe accounting for 4% and 3% of the total, respectively. Intermedia targets its frame relay service at medium-sized corporate and government organizations, which account for 80% of its customer base. The carrier also offers frame relay service to other network service providers such as ISPs.

Intermedia has NNI agreements with Nynex, BellSouth, Bell Atlantic, SNET, Ameritech, GTE, Pacific Bell, U S West, Bell Canada, AT&T, MCI, Sprint, TeleGlobe, Equant, WorldCom, and the UniSpan members.

In September 1996, Intermedia announced a quality-of-service guarantee that covers national transport, NNIs, and local loops. If the guarantees are not met, customers are reimbursed at the current rate for minutes lost. Other features include a customer network monitoring tool that monitors the PVCs within the network and free network tuning. In April 1997, Intermedia rolled out its ViewSPAN software for customer-based monitoring of multicarrier frame relay networks. The software works only with Cascade B-STDX 9000 switches.

Intermedia/UniSpan has concluded more than 250 frame relay NNIs with carriers worldwide. Most recently, Intermedia announced an agreement with Telecom Holdings Panama (THP) in September 1996; the exclusive two-year contract covers frame relay, Internet, and private line traffic between Panama and the United States. THP will market a frame relay service in Panama and will employ Intermedia as its distribution network for U.S., Canadian, and European frame relay traffic originating in Panama. Intermedia will use THP for U.S.-originated frame relay traffic terminating in Panama.

Document #: 14351

Publication Date: October 1997

Published Under Services: Business Network Services

EXHIBIT G

TO

BELLSOUTH'S NOI COMMENTS

SS7, ISDN, AND IN PROJECTED DEPLOYMENT

April 15, 1998

In its December 19, 1991, Order reviewing Open Network Architecture plans (CC Docket No. 88-2), the Commission directed each BOC to provide annual reports on the deployment of Signaling System 7 (SS7), Integrated Services Digital Network (ISDN), and Intelligent Network (IN) by percentage of access lines served system-wide and on a market area basis. This report contains six tables which provide these projections for BellSouth.

Table 3 provides a summary of Basic Rate ISDN deployment. The access lines counted in these percentages are lines served by central offices that are or will be equipped for ISDN capability. Equipment provisioning beyond the initial capacity will be based on market demand and forecast. These projections are based on current plans, but are subject to change due to financial, regulatory, market, or other considerations.¹

Table 4 estimates the deployment of Primary Rate ISDN. The access lines counted in these percentages are lines served by central offices that are or will be equipped for Primary Rate ISDN capability. Equipment provisioning beyond the initial capacity will be based on market demand and forecast. These projections are based on current plans, but are subject to change due to financial, regulatory, market, or other considerations.²

¹ In 1994, BellSouth established a plan to offer expanded access to ISDN via an alternate network serving arrangement which allows ISDN to be routed from a nearby ISDN-capable switch through a serving switch to a customer's home or office. This expanded access arrangement increases the percentage of customers with access to ISDN capabilities and these projections were announced to industry and media. However, BellSouth's deployment projections in this report are consistent with the Commission's reporting requirements for the ARMIS 43-07 Report.

² See Footnote 1.